DIVISION SCHALTER UND SENSOREN EUROPA

Valeo Schalter und Sensoren GmbH

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ET Docket 98-153

In the Matter of
Revision of Part 15 of the Commision's Rules
Regarding Ultra-Wideband Transmission Systems

Comment on notice of proposed rulemaking
FCC 00-163 adopted: 05/10/00

To: **The Commission**
Comments of: **Valeo Electronics**
Division Switches and Sensors Europe

Company profile:
Valeo is an automotive parts supplier, designing, manufacturing and selling components, systems and modules for cars and trucks. Valeo's products range from engine cooling systems, motors etc. to wipers , switches and sensors.
Currently in the switches and sensors division the development of a microwave radar based parking and backup aid is in work, which is planed to be the successing technology for the given ultrasonic systems.
Furthermore vehicle environment sensing functions with higher safety level like precrash alert or blindspot detection are assumed to be implemented in the next step.

<u>Comment on footnote 8:</u>
The x_dB bandwidth is highly related to the pulse shape. Practical radar pulse modulators with fast diode switches cannot easily achieve unsteady changes of the enveloping slope. Therefore most shapes (without further phase shifts, FM or any other type of pulse compression) become similar a cosine-square or gauss shape.
We propose to define the gauss pulse to be a standard shape, based on which all further calculations can be easily provided.
We would assume this model to provide better results compared with the estimation mentioned in footnote 8.
$x(t) = exp(-\pi(t/\Delta t)^2)$
exact $BW\_20dB\_gauss = 3.42/\Delta t$
estimation $BW\_20dB\_est\_gauss = min(2.25/\Delta t, 6.77/\Delta t) = 2.25/\Delta t$
This mathematical reference becomes important, if. e.g. peak time domain measurements should be avoided and a proper estimation of the pulse width for peak power calculation (with help of PDCF) has to be done with help of spectral measurements only.

<u>Comment on footnote 10:</u>
The necessary BW is used to define the intentional versus the spurious emission. According the rules only spurious emissions are accepted in the restricted bands and the fundamental emission (or necessary BW, whichever is less) shall be contained within designated bands, if the UWB is approved under the additional provisions of 15.217-255.
However we would like to comment, that a general definition of the necessary BW is not possible, whereas the fundamental BW does not reflect the functional intention at all. Due to that we propose to relinquish the juridical criterion of the intention of a transmission but to rely all definitions on hard physical facts.

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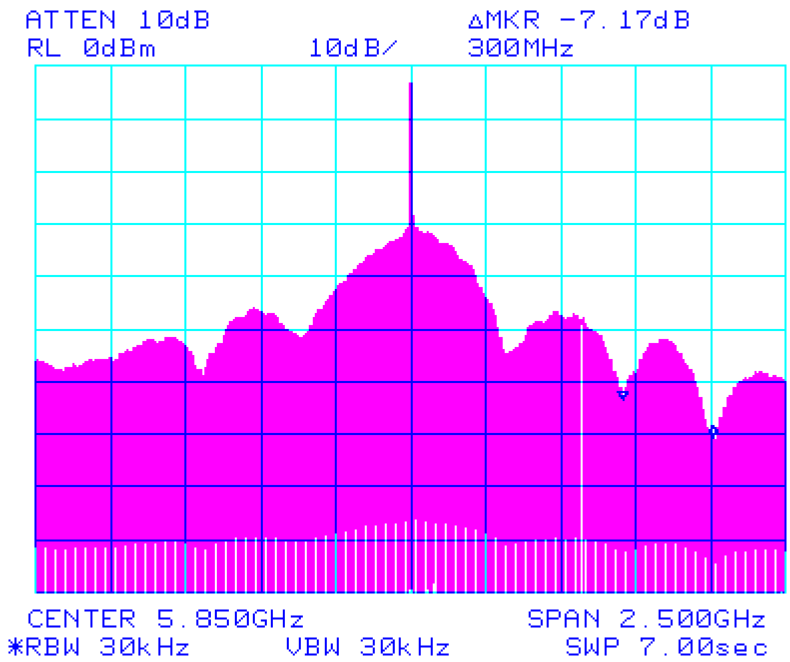
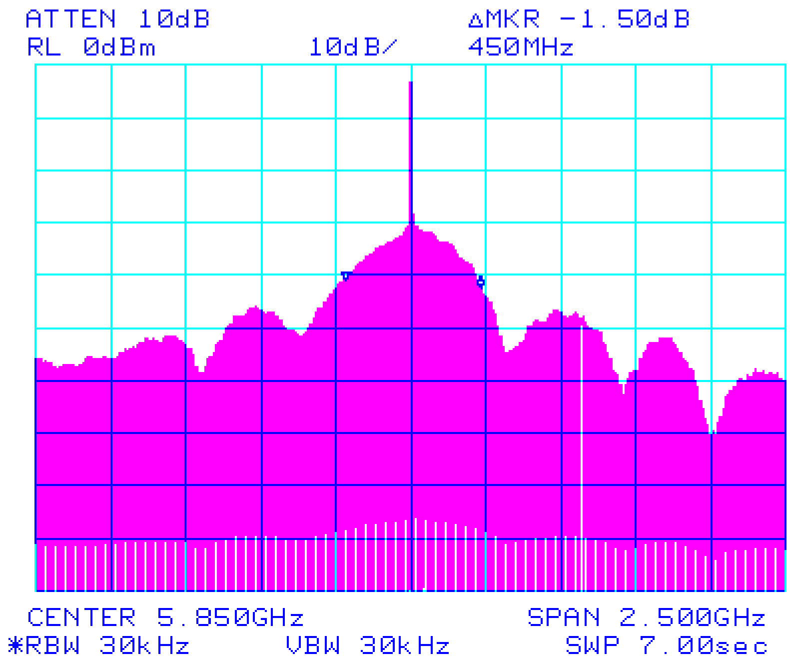
Concerning practical measurement needs we made some observations:
a) The measurement of an occupied BW (integral over spectral power density within the limits of the occupied BW = 99% of total amount of transmitted power) is nearly impossible, if you do not precisely know the total amount of power from another measurement and /or the spectrum drops to fast below the noise floor before achieving the integral limits.You can not measure and integrate the total amount of power in frequency domain for regular signals (signals with a finite duration), because their spectral distribution is infinite. Furthermore a mathematical compensation of the noise floor (white or colored) has to be provided.
If you keep to define the occupied BW as a relative ratio, which we assume is not imperative, then we further think, that you can get a precise result only, when considering the pulse shape in time domain.
You would have to approximate the given shape with a fitting mathematical function and therewith you could calculate the occupied BW. We think that procedure is impractical in real life.
b) The measurement of the fundamental lobe requires good visibility of the sidelobes to find out the nulling points between them. However often the sidelobes are supressed e.g. by the antenna transfer function or are distorted by further oscillator pulling and/or the nulling points already drop into the noise floor. The commitment on the nulling points then becomes impossible or very unprecise. If the sidelobes are properly visible, we propose to measure the spectral distance of the nulling points at the farest sidelobe beside the main lobe which is still above the noise floor.
If you consider a gauss shape you find out that its distribution in principle has no sidelobes. How to define the fundamental lobe then?
c) If you would introduce a realistic modulation shape reference (like the gauss shape as proposed above) you could define a relative magnitude BW (e.g. the –10dB BW) to be a measureable criterion and therewith replace the definition of the occupied BW.
With respect to the gauss shape as defined above, you can calculate
exact BW_10dB_gauss =2.42/Δt = BW_97%_occupied < BW_99%_occupied=2.91/Δt.

We would change the wording to define spurious versus intentional emission as follows:
In case of carrier-pulse modulated transmitters with no further compressing modulation (like FM, PM...) the spectral bandwidth of the intentional emission is defined by the fundamental lobe. If the nulling points can not be measured precisely, then the intentional emission BW is estimated by 1.2..1.4*BW_10dB.
(To get a better precision of the correction factor 1.2..1.4, you could take additionally into account the normalized amplitude of the first sidelobe.)



Measurement of fundamental and 10_dB Bandwidth

BW_fundamental = 2* BW_sidelobe = 600MHz



BW_10dB = 450MHz

BW_fundamental / BW_10dB = 1.33

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Comment on section 18:
Valeo is interested to introduce several automotive environment sensing applications. An individual license procedure for each final customer would make the marketing impossible.Therefore we absolutely agree with a general UWB regulation under part 15 on an unlicensed basis.

Comment on section 19:
High power applications, which are above the peak and/or average limits of general UWB's and are not established within the additional provisions of 15.217-255, should be approved with an individual license or under a product specific waiver.

Some automotive sensing devices could be designed to work in different modes with different transmission characteristics. For example a device could provide an ultrawideband low power mode with high range resolution and limited maximum detection range as well as a second narrow band mode with detoriated range resolution but increased maximum detection range. The approval of the device should be done for each mode, e.g. for the first mode according the UWB regulations and for the second mode according the additonal provisions of 15.217-255.
Furthermore it is possible, that a sensing device is continuously changing its transmission characteristics, while it is scanning the detection area from near to far. In that case a separated measurement of the emissions in a virtual near or far range mode would not make sense. We would propose that such a device should be approved according the additional provisions of 15.217-255, which should be complemented by the acceptance of intentional emissions beside the given band according the UWB standard.

As you easily can see in the screen shots above, the pulse radar spectrum contains a line at the carrier, which is much higher then the lines of the pulse comb spectrum. The magnitude of the carrier line is mainly determined by the achieved switch isolation (about 30dB). A further suppression of the carrier line could be achieved with a notch and/or with carrier FM modulation. The first approach could become critical concerning drift of the notch over temperature and aging. The second approach needs a very high modulation index to become effective.
Therefore we assume that to establish the carrier line several allocated bands are needed as already provided under the provisions of 15.217-255. Unfortunatley above 2 GHz only a small amount of bands are already allocated (@ 2.4, 5.8, 10.5, 24, 47, 76 GHz). Due to that fact the UWB's will be crowded together at those bands, though the intention had been to establish the UWB's everywhere in the spectrum without band concerns.
We would assume that it makes more sense to establish the UWB's regular over the spectrum instead of crowding them. You would reduce the interference risk as well as improve the design opportunities choosing the most appropriate wavelength concerning the needs of the application.
Therefore we urgently ask about to establish some more small band slots for carrier settlement. We would tentatively propose to define some small slots comparable with the bands given for field disturbance sensors. We would propose to set those additional slots in the center of the gaps between the restricted bands, if possible.

Comments on section 21:
We agree into your proposal to define the UWB's according their –10dB bandwidth. We also consider the –10dB emission points to be easier measurable then the –20dB emission points. Additionally we would like to mention, that the-10dB emission points are unambiguously settled on the fundamental lobe, because the sidelobes are minimum –14dB below the maximum of the fundamental lobe.
We do not agree to take a time domain measurement of the pulsewidth to qualify a device to be an UWB. We would prefer to perform a more practical measurement in frequency domain, which in one step can show the bandwidth as well as the related carrier or center frequency . A time domain measurement would additionally have not only to take the 50% pulse duration but the total shape into account.
We transferred the proposed limits of 25% fractional bandwidth or 1.5GHz absolute bandwidth w.r.t. the –20dB emission points to adaequate values w.r.t. the –10dB emission points. The calculation was performed based on a gauss reference puls shape. Due to the results we propose to reduce the definition limits to 17% fractional bandwidth or an absolute –10dB bandwidth of 1 GHz.
We agree into a handover of the fractional criterion to an absolute criterion at 6 GHz to avoid obsolete trash emissions above.

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We do not think that UWB's should only be defined to be a pulsed modulation without any further modulation. Ultrawide spectral distribution can also be achieved e.g with analogue FM, PM or with discrete FSK or PSK. All those modulation types could additionally be amplitude or pulse modulated.

But let us consider first the interference potential of a pulsed transmitter without dithering on a victim receiver with a receiver BW of 50MHz. For simplification no PRF dithering is assumed.
A single line of the comb spectrum has a power of *P_line = P_peak_dB +20log(PRF/BW_pulse).*
The victim receiver can reconstruct partially the peak response with that amount of single lines, which fall within its receiver bandwidth, which is equal *B_vict /PRF*. The line amplitudes are superponed in phase at that time, when the peak occurs and therewith the single powers are summed up correlated. The peak reconstructed by the receiver is
P_vict_peak = P_peak_dB +20log(PRF/BW_pulse) +20log(B_vict/PRF)
= P_peak_dB +20log(B_vict/BW_pulse)
The real pulse peak power is attenuated by the factor *20log(B_vict/BW_pulse*), which in fact you propose in section 43 as an reasonable increment of the given limit.

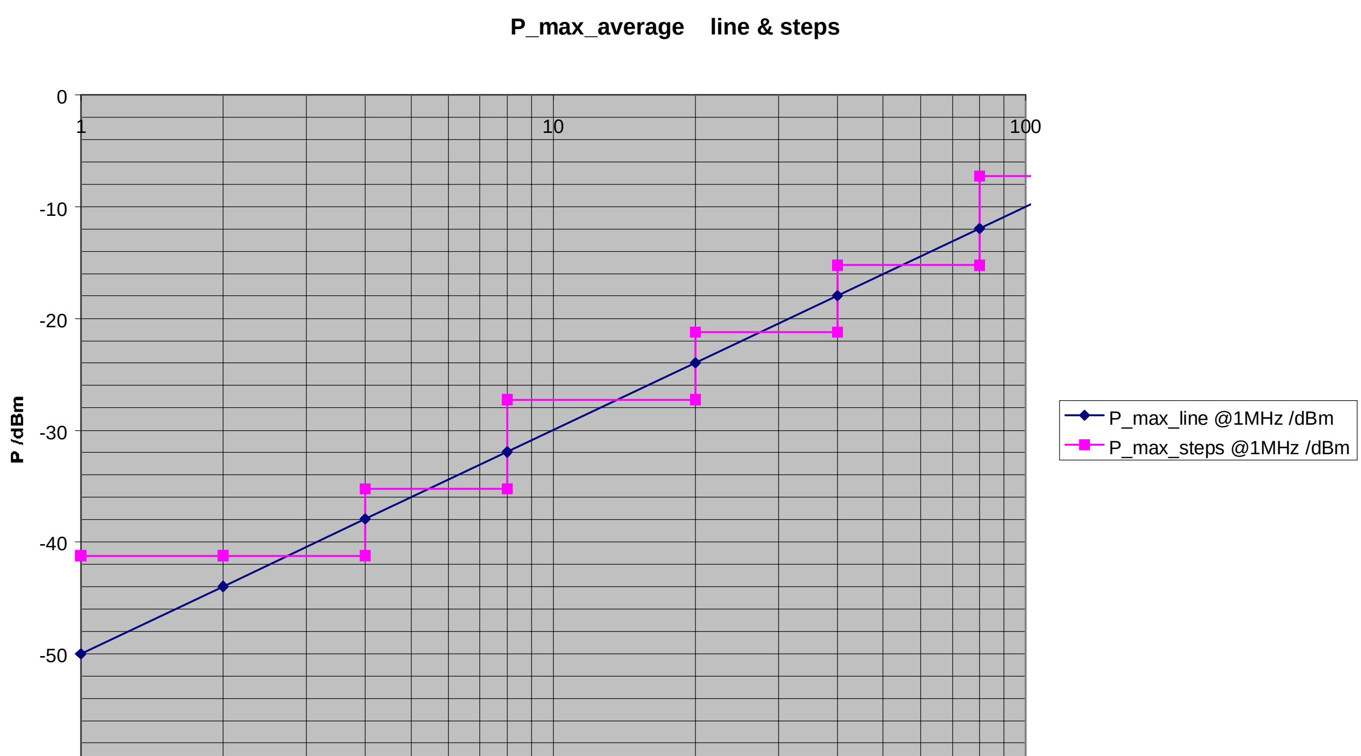
If we consider now different systems e.g. a FMCW, which provide the ultrawide spectral distribution by frequency chirp on time domain, we tentatively conclude, that you have to consider the maximum interference time, at which the transmitter stays continuously within the bandwidth of the receiver.
*Δt_interfere = B_fmcw/B_vict. * T_chirp_fmcw.*
We assume that for most realistic cases the reciprocal of *Δt_interfere* is below the 50MHz bandwidth of the reference victim receiver and therefore the transmitter CW burst is received without power reduction.
FMCW also can be pulsed (e.g. for reduction of the average transmit power and/or the power consumption). For our opinion the according duty cycle only could be used to argue for a further increment of the CW peak power above the average power for more then the given 20dB, if the duty time is shorter then the reciprocal of the victim receiver bandwidth. In that case you can consider the system with a factor like the pulsed systems. (*20log(B_vict*t_duty*).

<u>Comments on section 27:</u>
We absolutely agree with your proposal not to restrict UWB's above a certain frequency concerning intentional emissions in the given restricted bands , e.g. above 2 GHz. Most established narrow band applications keep below and therewith are protected whereas the applications above often use high directional antennas for needed gain and due to that fact an interference exactly in the receiver antenna solid angle keeps very unlikely.
With respect to the propagation loss we would propose to establish a variable frequency related power limit instead of a fixed limit of –41.25dBm (500µV@3m). The thermal input noise power density kT of a given receiver (we assume a 0dB isotropic antenna and a 3dB receiver noise figure) could be used to calculate a minimum range R_noise, where a signal of a transmitter with a given power density dP/df of –41.25dBm/1MHz = -101.25dBm/Hz drops below the internal noise floor of –171dBm/Hz.
If you keep in mind that the effective receiver aperture is related to the second power of the wave-length λ as well as the receiver input power is attenuated w.r.t. the square of the distance to the transmitter, you will get a very simple expression:*R_noise* = $k*\lambda$ (k = 244 @-101.25dBm/Hz).
If e.g. we consider a transmit carrier at 7.5 GHz with a wavelength of 4cm and –41.25dBm CW power, roughly at 10 meters the transmitted signal would drop below the thermal input noise within the receiver described above. If we calculate the same for a carrier at 30 GHz, this would happen at 2.5 meter accordingly.

Now we would propose instead of establishing a fixed power density limit of –101.25dBm/Hz to define a fixed minimum noise range. If for example you would accept a noise range of 10 meters, the power density would increase proportional with the frequency. We would propose not to take the center frequency but the lower frequency of the –10dB emission point to classify the acceptable

average power density of a given UWB system.
With such a rule you also would not have to define a hard frequency limit (e.g. 2 GHz) without further restrictions, above which UWB's would be accepted, but the accepted power limit would be decreased continuously in the lower areas which already are settled by classical narrow band devices.
With the parameters given above we would propose to define the power for UWB's to be
P_max_average = -230dBm +20log(f_lower).
(w.r.t. 1MHz measurement bandwidth, T = 273K, R_noise =10meter)
With this rule the power limit cutting point of –41.25dBm is related to f=2.74GHz.
If you want to simplify the proposal above with discret stages, we would propose the following:

f_lower10dB / GHz	2...4	4...8	8...20	20...40	40...80	above 80
E_tx_max_ average @ 3m / mV	0.5	1	2.5	5	10	25
P_tx_max_ average /dBm	-41.25	-35.23	-27.27	-21.25	-15.23	-7.27



Comment on section 29:

We expect automotive Radar systems to be designed at carrier frequencies above roughly 4GHz, due to the fact that the antenna aperture dimensions are proportional to the wavelength and the space for vehicle integration is limited.
Concerning the protection of GPS we assume that such automotive Radar systems above 4GHz will have their lower –20dB emission point highly above 1.6GHz. With the power limits proposed in the comments on section 27 the noise range at 1.6Ghz would be much less then 1 meter accordingly. We expect that a noise range limit of 1 meter is more then enough to protect GPS from an increased noise floor under practical conditions.
If the lower –20dB emission point of any UWB device is above 1.6GHz, we tentatively conclude, that a further protection of GPS is not needed. Your proposal of an additional power reduction of –12dB for UWB devices settled below 2GHz would therewith be more then fullfilled.
If the lower –20dB emission point is below 1.6GHz ,we assume that with high technical effort like a precise notch filter or a stabililised PRF higher then the GPS bandwidth of about 2MHz and furthermore a PLL/quartz carrier stabilisation a power reduction at the L1 band could be provided. But we also assume that mass market low cost devices can not afford this solutions. Additionally with the latter approach a further PRF dithering to achieve a smoothy spectrum would become impossible.
We do not think, that with the latter approach the total radionavigation band from 1559-1610MHz could be kept free from spectral modulation sidelines of any pulse radar. This would require a PRF above 51MHz and therewith the unambiguity range would be reduced to less then roughly 2 meters.

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Comment on section 33:
We consider the extrapolation of an interference risk for different receivers w.r.t. the parameters mentioned in section 33 is in principle the most suitable approach. In practise it could become a difficult job to fairly compare the different systems due to the high amount and complexity of the parameters.
We assume that you already have established a standard victim receiver model, which reflects into the measurement parameters already given in part 15.
We do not agree that all kind of receivers have to be protected in the same manner. If for example spread spectrum technology or UWB's are using a high amount of spectrum, such systems can normally provide sufficient processing gain for interference mitigation.
We would propose to establish a maximum burst time limit (e.g.100µs) , which an interference burst on the given 50MHz standard victim receiver should not exceed, so that implemented interference mitigation strategies keep a chance.
W.r.t. that burst time limitation we tentatively propose that a further transmit power increment is reasonable, if the burst repetition keeps below a certain duty cycle. We would establish such a possible power increment for UWB systems, which achieve the ultrawide bandwidth by frequency chirp in time domain (e.g. FMCW) and which are not affecting the given restricted bands at all.

Comment on section 34:
ad sub 1)
We cannot give a general statement for all kind of services. But we think that the history successfully proved the limits, which are currently implemented into the FCC rules, especially for classical AM/FM narrowband services, which are allocated in the restricted bands.
ad sub 2)
We agree into a limit definition based on a spectral power density. We furthermore highly welcome a definition, which would reward and support the design of a smoothed noiselike spectral power distribution.
According our experience we could not find up to now any external interference of a pulsed UWB to classical narrowband radio devices or spread spectrum wireless services. But against mutual interference between pulsed UWB's the dithering is a very effective mitigation strategy and for our opinion should be encouraged.
For the latter intention we propose the reduction of the minimum measurement bandwidth for the average measurements from 1MHz to about 100kHz (which is currently the ETSI standard). With this reduction you would encourage the designer to establish a very even average power density, if the power limit would be kept constant or only partially reduced. Vice versa the power density would be partially increased. We would propose to increase the power density with about 4dB from
–101.25dBm/Hz (resp. 500µV @3m = -41.25 dBm measured with 1MHz) to
–97.27dBm/Hz (resp. 250µV @3m = -47.25 dBm measured with 100kHz).
This does mean a total power limit reduction of 6db, if the smaller measurement bandwidth of 100kHz is applied. The increment of the power density by 4 dB would be the incentive for the designer to achieve a very smoothed spectral distribution accordingly.
Due to the fact that the peak measurements would be still performed with 50MHz measurement bandwidth, the BW reduction for the average mesurements is no additional risk.
Furthermore we would propose to establish both alternatives for approval measurements into the UWB rules as explained above. The first limit definition with 500µV @3m and 1 MHz BW would match on systems without dithering, data scrambling or any other smoothing technology. The second limit definition with 250µV @3m and 100kHz BW would match on systems with some kind of sophisticated smoothing technology or pseudonoise coding.
In case of pseudonoise coding or any other kind of smoothing technology you should define an appropopriate maximum average time for the measurement (currently 100ms). We would propose to take the same limit which is the longest acceptable interference burst time within the standard receiver bandwidth (e.g.100µs, see comments on section 33).
ad sub 3)
If you would establish a maximum noise range of about 10 meters (as proposed in comments on section 27) we assume the cumulation risk to be neglectible. In that case we assume the thesis only to consider the next transmitter for interference potential is correct. Furthermore there is a low probability that all cumulated UWB's in a certain situation are active at the same time and additionally their antenna directions are identical.
ad sub 4)
We agree into your proposals of section 43.
ad sub 5)

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The reduction of emission BW with further filtering as well as notch filters for dedicated bands can affect the UWB performance (e.g. IF ringing). This highly depends on each kind of application and a general statement cannot be provided. (see comments on footnote 10. The necessary bandwidth is not equal the fundamental bandwidth, but highly depends on the quality requirements of the provided service).
ad sub 6)
...question does not apply for automotive applications
ad sub 7)
We expect the operational restriction „ignition on“ to be acceptable for UWB environment sensing vehicle applications. This does not apply to vehicle protection systems (thief intrusion alarm, keyless &handless entry etc.).
Further operational restrictions w.r.t vehicle speed, reverse gear or indicator activation would make the design of security vehicle environment sensing applications impossible.

<u>Comment on section 35 and footnote 105:</u>
Generally we believe that with the PDCF applied on a line spectrum s.o. can provide correct peak power estimations based on spectral measurements only.
(*for* $RBW\_max<0.3\ PRF,\ P\_peak = P\_line - 20log(PRF*\Delta t\_eff)$).
For this calculation you have to know the effective pulse power duration, which you can easily get from frequency analyser measurements of the fundamental BW. $\Delta t\_eff = 2 / BW\_fundamental$. If the nulling points between the lobes cannot be precisely identified, you can take the assessment $\Delta t\_eff \cong 1.4...1.7 / BW\_10dB$. We achieved results with a failure less then 1dB.

A PDCF applied on an impulse spectrum on the one hand provides an improved S/N, because more then one line is integrated in the measurement. On the other hand for our opinion the RWB of the analyser should be much higher then 10*PRF.
($10\ PRF< RBW<0.2/\Delta t\_eff,\ P\_peak = P\_lobe - 20log(1.5RBW*\Delta t\_eff)$)
Standard analyser equipment allows a maximum RBW up to roughly 2MHz. Therefore only PRF’s up to 200kHz could be measured with an impulse spectrum accordingly. Furthermore the correction factor of 1.5 varies with the unknown pulse shape and the equipment properties . Due to that facts we prefer the line spectrum measurement.

If you still urge to apply a time domain measurement to get the t_eff, then you have to take into account, that a DSO delivers amplitudes, but not temporary powers. You would have to calculate the effective pulse power duration with respect to a function fitted and integrated over the total pulse shape. That’s another chance to produce failures. $t\_eff = Int(square(x(t)/x\_peak))dt$.

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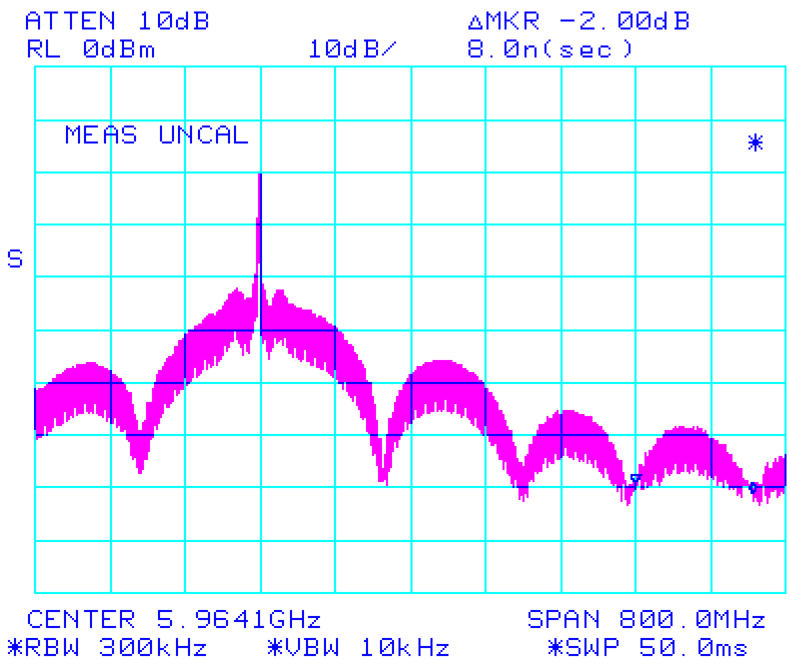

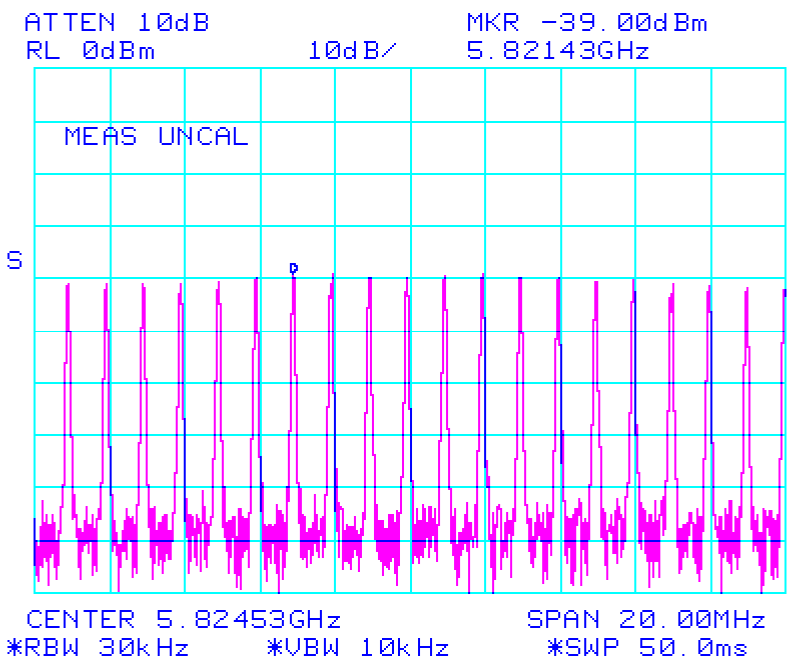

Estimation of pulse power w.r.t .a line spectrum. PRF=1MHz, t_eff=8ns, P_line = -39dBm

⇨ P_peak = -39dBm – 20log (1MHz*8ns) = 2.94dBm

⇨ P_cw_switch_closed_static = 2.5dBm, , ΔP = 0.44dBm

If in the past the PDCF was applied on each single line of the pulse comb spectrum, in our opinion this was an error and in contradiction to the mathematical principles of a fourier series. The fourier theorem means, that a pulse series in time domain can be replaced by an infinite number of continuous discrete coherent CW sources. Such single sources are

equivalent to each line in the comb spectrum and not switched or pulsed in any further way. Therefore the additional application of the PDCF w.r.t t_eff on each line did not make sense.
The single CW sources of the transmitted comb line spectrum are coherently locked due to the fact that they are deviated from a common source. The PDCF *20log(PRF*Δt_eff_UWB*) reflected the case, that a virtual victim receiver would have a bandwidth equivalent the fundamental of the transmitting UWB and the single powers of all lines would be summed up coherently within the receiver stage. We estimate that case to be very unrealistic.
Nevertheless if a more realistic worst case of victim receiver with e.g. 50 MHz BW is taken into account, you simply have to replace *Δt_eff_UWB* with a fixed value w.r.t. the properties of the standard victim receiver *Δt_eff_vict = 1/50MHz=20ns.*
If you easily want to calculate the peak power based on a simple measurement of the line spectrum, which could possibly be received by the victim receiver, you first have to find out the number of lines within the victim receiver BW. *n = 50MHz/PRF*. Then take the power of a single comb line and multiply with the PDCF. According your proposals a peak power of –21.25dBm(5000mV @ 3m) should not been exceeded. *–21.25dBm < P_line-20log(n*).
You can do the same for transmitters without a discrete line spectrum due to dithering, data scrambling or any other smoothing technology. You simply have to take the steady power density into account and
numerically integrate over a gap of 50MHz. The noise floor should be subtracted before. The integration result should not exceed –21.25dBm.

Comments on section 36:
see our comments on section 29

Comments on section 37:
see our comments on section 34-2. It would be in the own intereset of the designer to establish scrambling, if you encourage this with an alternative measurement mode (e.g. –47.25dBm w.r.t. 100kHz).

Comments on section 39:
According our proposal on section 27 to introduce a constant maximum noise range of 10meters you we would achieve a further suppression of –12dB below the given limit of –41.25dBm at frequencies below roughly 700MHz.

Comments on section 42:
We assume that power limits based on RMS are appropriate as long as the spectral power density is considered with a frequency analyser. If you plan to establish time domain measurements with a homodyne receiver mixing the RX signal on IF=0 to detect any peaks, then we assume the real peak maximum would have to be considered.
We believe that your first proposal to measure over a bandwidth of 50MHz is appropriate and comparable to the worst case of a likely victim receiver. We furthermore believe, that a simple measurement procedure with a frequency analyser is sufficient for that.(see comment on section 35)
Concerning your second proposed method we do not believe that peak measurements over the total entire UWB bandwidth are necessary and we have doubts about the measurement feasibility as well as the availability of the equipment needed.

Comments on section 43:
We agree into your proposals. If a measurement over 50MHz would be sufficient according your first proposal of section 42, then a further calculation of the real maximum peak power would be obsolet. The approval procedure only would have to prove that within 50MHz measurement bandwidth, which has to be shifted over the total spectral measurement range, the average power limit is never exceeded more then 20dB.

W.r.t. the calculation of the real peak power we do not see a physical reason to establish an absolute limit of 60dB utilised with 5 GHz, which does mean a maximum peak power of 18.75dBm or a maximum applicable PDCF of 60dB.
If you calculate the isotropic range, at which a potential health hazard EM radiation level of $1mW/cm^2$ would be achieved, you would have come nearer then 2.5cm. We assume that the near field propagation will be less. If we compare the data with GSM handy emissions, we conclude that you could increase the limit by 10dB to roughly 30dBm.

Comments on section 47:

See our comments on section 34-3. Cumulated UWB's with fixed or randomised PRF's are very unlikely to produce a common interference beat. On the one hand the transmitted pulse trains are not produced by a common oscillator source and therewith their amount of power could only be superponed incoherently.
On the other hand the carrier frequencies of different UWB's are not locked. In most cases the frequency difference will be great enough that both interferences are not dropping into the victim receiver at the same time.
Last not least the PRF oscillators are also not locked. If you additionally prefer dithering the probability to get a PRF lock exactly at the time when a victim receiver could have the chance to get any interference becomes very unlikely. That's another reason to encourage pseudonoise coding.

Comments on section 50:

See comments on section 34-2. Above 1GHz we propose to require average measurements alternatively with 1MHz or 100kHz RBW and appropriate power levels accordingly (-e.g.500µV/m at 1MHz or 250µV/m at 100kHz).
We agree into a limitation of the min/max average time by a video bandwidth of 10Hz<VBW<10kHz for pulsed systems.
We believe that systems, which provide an UWB bandwidth by other types of frequency or phase modulation in time domain(e.g. FMCW), should have a limited interference time of about 100µs on the described standard victim receiver of 50MHz. If you transfer this conditions on the average measurement with an RBW of 1MHz, the interference time should not exceed 2µs, which does mean to establish a VBW above 500kHz for time domain tuned devices. (plus peak hold function)

Comments on section 52:

See comments on section 35. We believe that a PDCF based on the variable UWB bandwidth reflects an unrealistic and arbitrary interference scenario. Why should any victim receiver provide such a high receiver bandwidth, which exactly corresponds to the considered UWB transmitter?
We also believe that a line spectral power measurement in case of dithering turned off and and a PDCF application w.r.t. 50 MHz can easily provide the interference potential of a peak level received with the defined standard victim receiver.
In case of dithered devices we assume that the analyser span could be set on 50MHz and the power density could be integrated. Before that step the noise floor should be measured and subtracted.
If you prefer the measurement of dithered devices with a true pulse spectrum, then it should be taken care that the RBW is ten times higher then the PRF.
The usual equipment in most cases cannot fullfill that condition.We tentatively assume that you could make an extrapolation of the powers measured with the RBW stepped over the range of the equipment to get an estimation of the peak power at RBW 50MHz. If we assume a RBW of 2MHz of the equipment, then this method could maybe applied to PRF's below 200kHz.

We generally believe that peak measurements on time domain are obsolet and spectrum analyser measurements with PDCF are sufficient. If you urge on a time domain measurement, we assume that a down conversion with a receiver with 50MHz BW and a further IF analysis with an osscilloscope is appropriate but not really needed.

Comments on section 53:
We assume that this method could only be applied on devices with fixed PRF. We believe that line spectrum analysis using the PDCF provides much better results under fixed PRF condition. We worry about the equipment needed especially for the BW's of mixer and DSO. We do not believe that currently any peak power probes with a sufficient BW equal or greater then a typical UWB BW are available on the market.

Comments on section 55:
We believe that for systems with the lower –10dB emission point above 1GHz the given measurement ranges are appropriate referenced on the carrier or center frequency.
Furthermore we assume that some definition problems of the measurement range for basis pulse systems (carrier frequency below 1GHz, extremely narrow pulses) could be avoided when considering the –10dB emission points instead of the carrier frequency as a reference of a spectral range definition.

If you have any further questions w.r.t. to the content above, please contact
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